







“A Contribution to the Knowledge of Protection against Infectious Diseases.” By ALFRED LINGARD, M.B., M.S. Durh., Diplomate in Public Health, Cambridge. Communicated by Dr. E. KLEIN, F.R.S. Received December 3, 1888.

It has long been known, and it is now a well-established fact, that various eruptive fevers and blood diseases from which the mother may suffer, can be communicated to the foetus *in utero*. There is evidence also to prove that a disease may be transmitted to the foetus through a mother who is herself insusceptible to contagium, as in the case of a child having been born covered with small-pox eruption, the mother being quite free from it. The following are the diseases upon which the most important observations have been made:—Syphilis, small-pox, tuberculosis, anthrax, and relapsing fever. In the three latter the organisms producing these diseases have been found in the body of the foetus at birth, having passed through the placental vessels.

In the present paper I wish to contribute to the other side of the question, viz., the relation existing between the foetus and its mother, or, in other words, *the influence, if any, exerted by the foetus on the mother, when the foetus becomes the subject of an infectious disease contracted independently of the mother*. All the comments made from this standpoint have, with the exception of one, been in relation to syphilis; the one being an instance communicated by Vidal, of a father attacked at the time of conception with small-pox, the foetus at six months being covered, during the whole of which period the mother remained healthy. With regard to syphilis, we are indebted to Colles for the first practical observation noted in 1837, when he cited as a curious fact, that he had never witnessed or even heard of an instance in which a child deriving the infection of syphilis from its *parents*, had caused an ulceration in the breast of the mother.

At the present time, however, we are able to go a step farther, and say—

(1.) That a healthy woman become pregnant by a syphilitic man, may give birth to a syphilitic child, and still remain healthy herself.

(2.) That this woman suckling a syphilitic child is not exposed to contagion from it.

This singular immunity remains only to be explained, and we have to determine whether it is not explicable, as one is led to think, by a special kind of protection derived from the foetus.

Several years ago it occurred to me as feasible to attempt the elucidation of this proposition by means of some virus other than that of syphilis, this disease having been found incapable of communication to the lower animals. For this purpose none appeared to be more suitable than that of anthrax, on account of the properties and life-history of this organism being so well understood, and also by reason of the very short period of time this disease takes to run its course to a fatal termination after inoculation in most of the lower animals.

The results of this investigation I propose giving in the following pages:—

I. It is possible to directly inoculate a foetus *in utero* of a living rabbit with an active growth of anthrax, without the bacillary disease being communicated to the mother; and further, the remaining foetuses of this pregnancy under certain conditions have been found to receive a like protection. A control animal subcutaneously inoculated with the same growth died in sixty-eight hours.

II. The mother may give birth to a litter of healthy young ones some days later, with the exception of the one primarily inoculated with anthrax, which is always dead when born. The longest period of parturition after inoculation was ten days.

III. The blood of the mother during the time intervening between the inoculation of the foetus and parturition does not reveal the presence of the anthrax bacillus when examined—

(i.) By fresh cover-glass preparations.

(ii.) By aniline stained cover-glass preparations.

(iii.) By cultivations, gelatine at 21° C., and agar-agar at 37° C.

(iv.) By symptoms when animals were inoculated with it.

IV. The mother subsequently inoculated with the blood of an animal dead of anthrax, whose blood was swarming with the *Bacillus anthracis*, does not succumb, but is found to have received protection. The control animal died in forty-eight hours.

V. Twenty-four hours after this second inoculation to prove protection or otherwise, no anthrax bacilli were found in the blood of the mother. Proved as in No. III.

VI. The same animal, when re-inoculated with the anthrax blood eight months later, was proved to be still protected.

VII. The shortest period observed intervening between the inoculation of the foetus *in utero* and parturition, after which the mother was found to be protected against the inoculation of virulent anthrax blood, was thirty-six hours.

VIII. For the protection of the surviving foetuses, or those other than the one primarily inoculated with anthrax *in utero*, a longer exposure is required than the minimum thirty-six hours observed to protect the mother. Or the surviving foetuses may have received protection, provided that a period of not less than six days have elapsed between the primary inoculation of the foetus *in utero* and parturition.

IX. In those cases where the mother died of anthrax contracted at the time of the inoculation of the foetus *in utero*, and excepting the last-mentioned one, the heart's blood of the other foetuses *in utero* was not found to contain any anthrax bacilli, as proved by cultivations when the examination was made, several hours after the death of the mother. But if the examination and cultivations were made some sixty or seventy hours later, then any or all of the foetuses, according to the temperature of the air prevailing, may have anthrax bacilli in their blood.

[X. The inoculation of a foetus *in utero* with anthrax may produce one of three results:—

- (i.) If during the inoculation of a foetus the anthrax bacilli gain entrance into the tissues of the mother, owing to imperfect manipulation, the mother naturally succumbs to the disease.
- (ii.) In some cases the organisms pass through from the foetal to the maternal vessels; this is probably due to some change taking place in the placental tissues, either inflammatory or traumatic in origin.
- (iii.) Lastly, in those cases where the foetus alone is inoculated, the mother remains free from the bacillary disease, and at a later date is found to have acquired immunity.—Jan. 22, 1889.]

XI. In sections of the placenta of the foetus primarily inoculated with anthrax *in utero*, and through which the mother received protection, the anthrax bacilli, after staining with aniline dyes, are to be seen wholly in the foetal, while there is a total absence of them in the maternal portion.









